



ATMOSPHERIC & SPACE TECHNOLOGY RESEARCH ASSOCIATES

SCIENCE + TECHNOLOGY + APPLICATIONS // *Bringing it all together*

Dr. Geoffrey Crowley

ASTRA - Boulder, CO

Current Team Members

**NWRA (1A and 1B): Drs. L. J. Nickisch, Chad Spooner, Sergey Fridman,
Mark Hausman, Greg Bullock, Dennis Knepp, Shawn Kraut**

Zunicalc (1A and 1B): Dr. George Zunich

ASTRA (1B): Dr. Clive Winkler and ASTRA staff

ASTRA is a Small Business

Modeling

**Data
Assimilation**

**Data
Services**

**Ground-based
Instrument
Development**

**Space
Systems**

**Physics-Based
Modeling
(TIMEGCM)**

**High-latitude
Electrodynamics**

**Space Based
Data**

HF TID Mapper

CubeSat Missions

NSF DICE CubeSat

AF DIME CubeSat

SENSE Cubesat

**Real-Time
Specification
of
Ionosphere/
Thermosphere**

Global Ionosphere

**Ground Based
Data**

**Low Power
Ionospheric
Sounder**

Plug-N-Play Avionics

**Thermospheric
Neutral Density**

**Forensic Space
Weather
Analysis**

**GPS-based Space
Weather Monitor**

CubeSat Instruments

**Scanning
UV Photometer**

E-field Double Probe

Topside Sounder

Wind Profiler

**GPS-based Space
Weather Monitor**

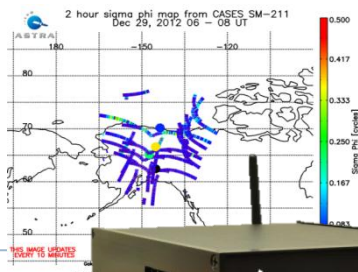
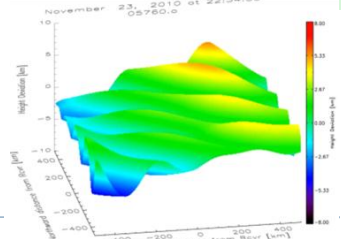
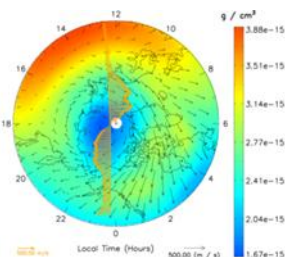
**Satellite Drag &
Ballistic
Coefficients**

**Space weather
Phone Apps**

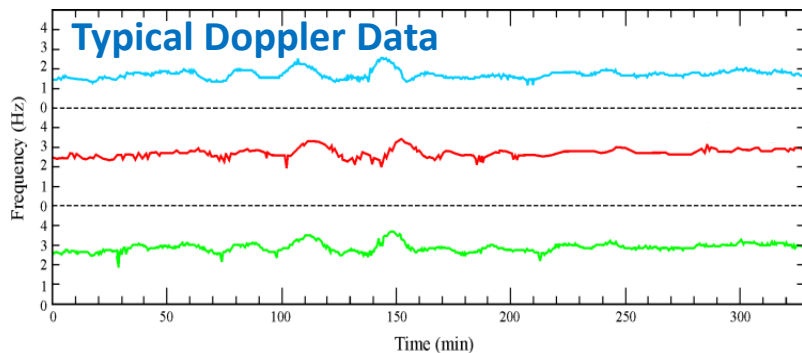
**E-fields and
Magnetometers**

Lidar Systems

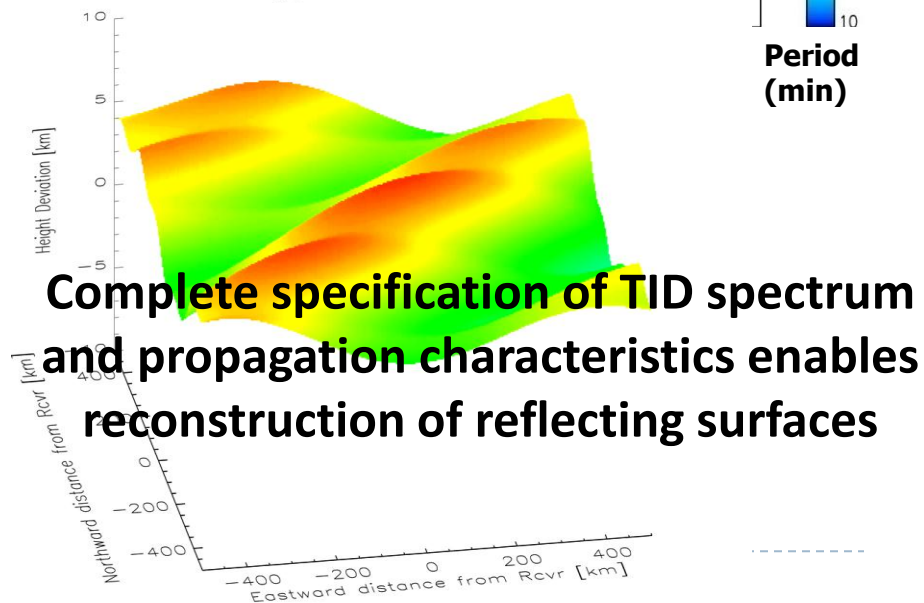
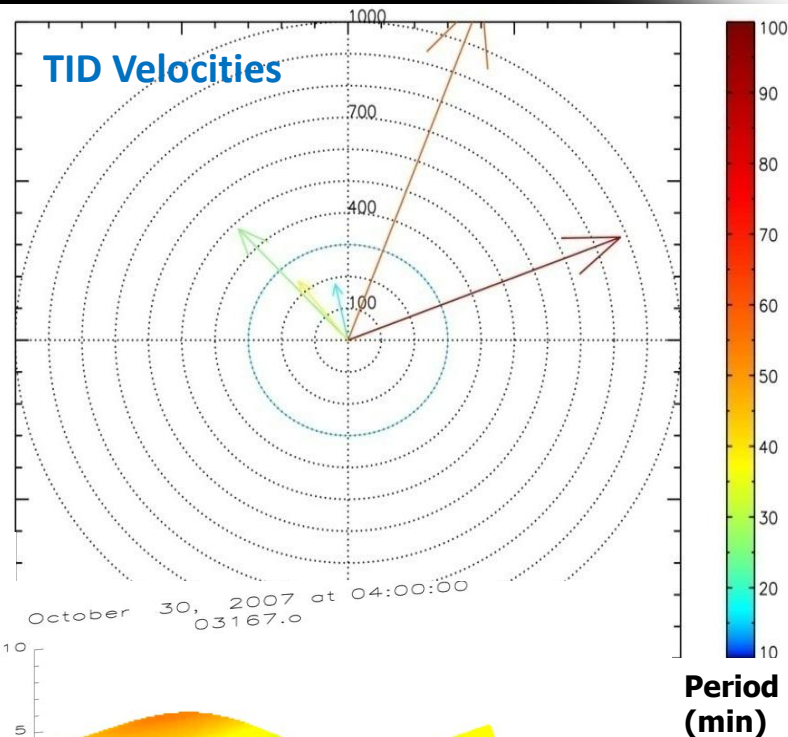
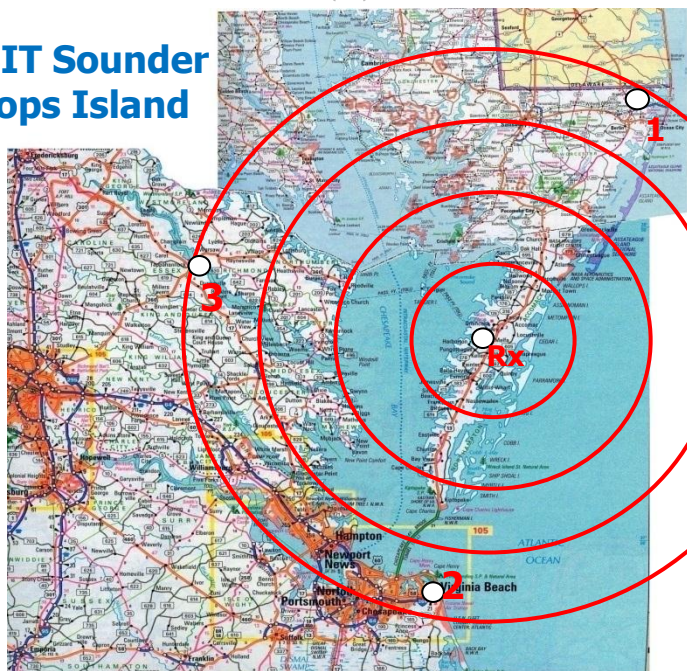
**Satellite
Aerodynamics**



Hardware & Analysis: e.g. HF Doppler Systems (Tx/Rx)

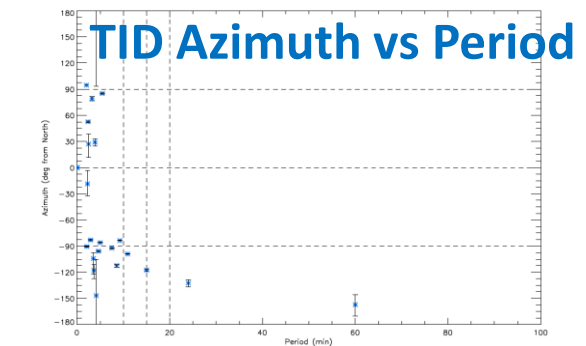
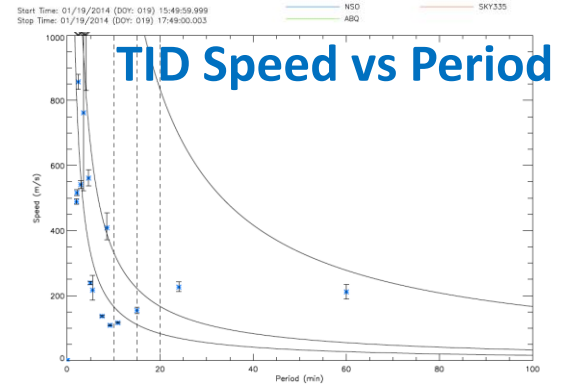
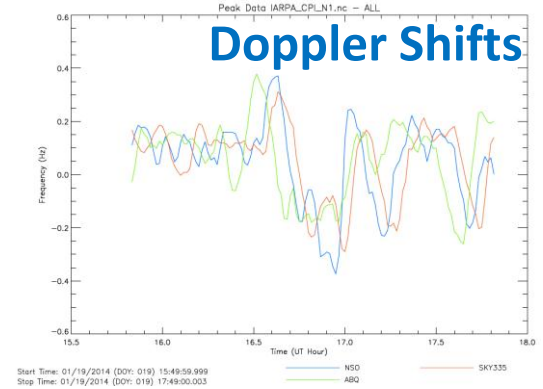
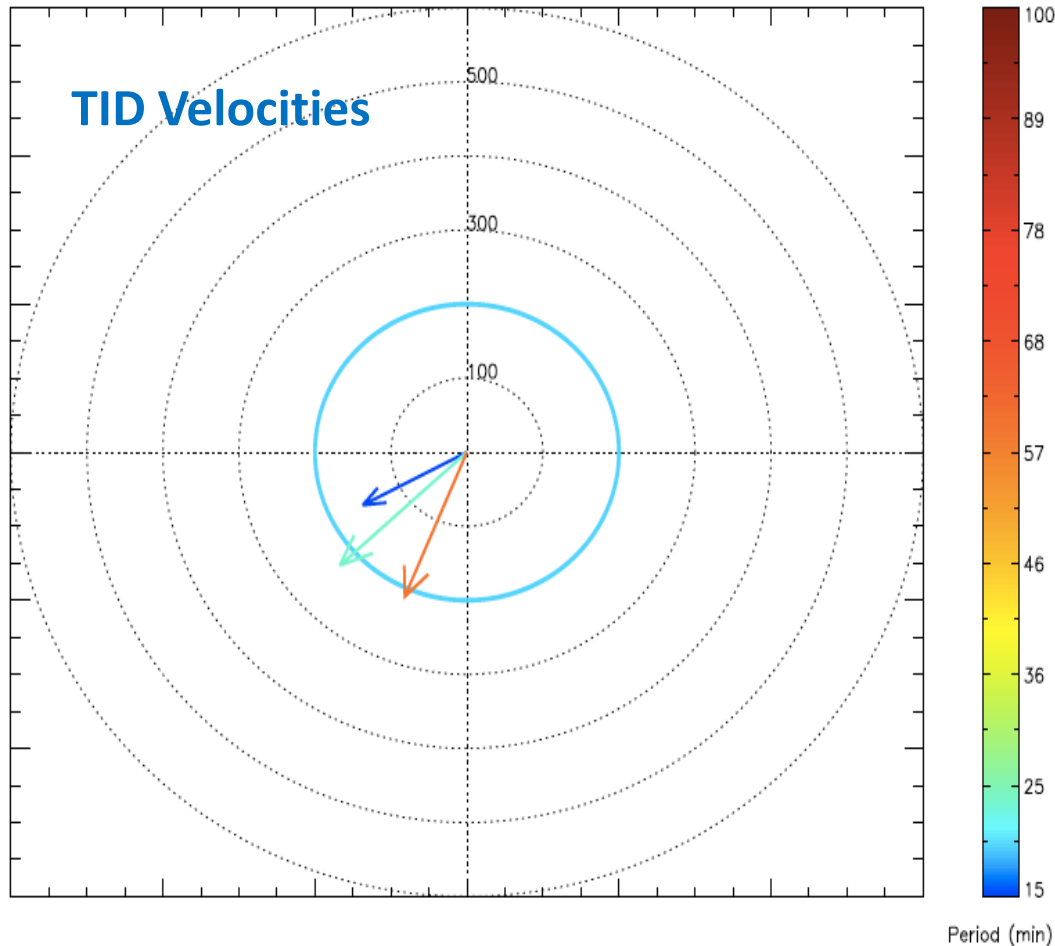


TIDDBIT Sounder @ Wallops Island



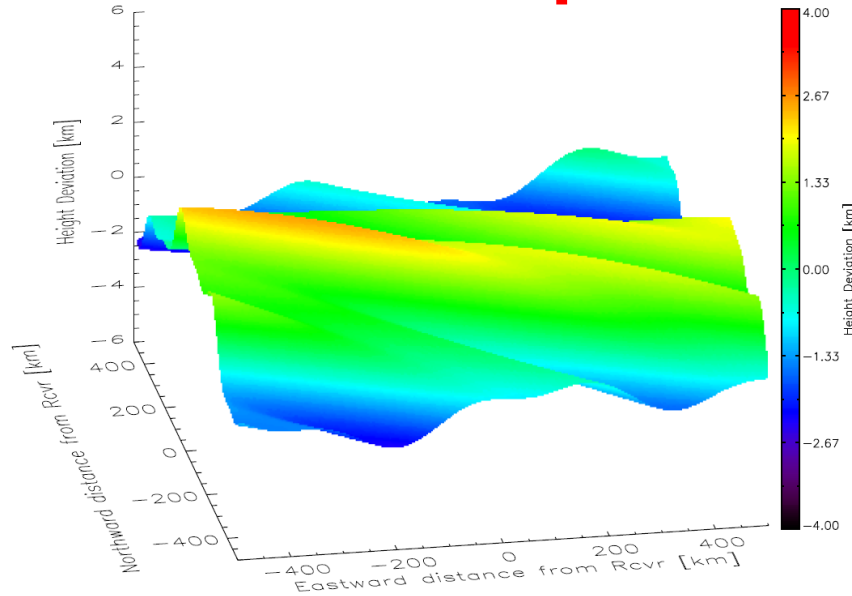
IARPA Phase-1B Experience

Transmitter: 1
Receivers: 3
Jan 19, 2014
2-hr window



IARPA Phase-IB Experience

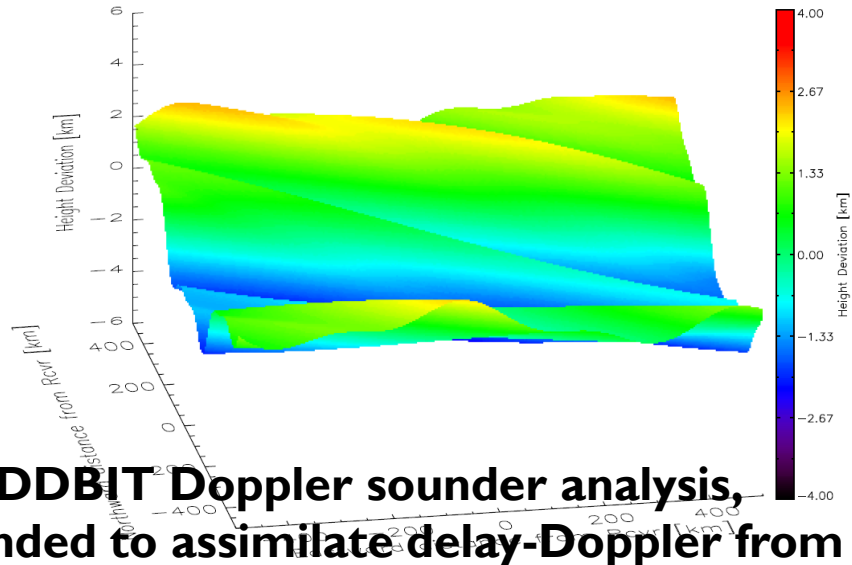
Snapshot #1



30 min elapsed



Snapshot #2



Motivated by ASTRA's TIDDBIT Doppler sounder analysis, NWRA's GPSII was extended to assimilate delay-Doppler from known HF links

ASTRA (teaming with NWRA) seeks groups needing:

➤ **Hardware:**

- **HF Doppler Systems (transmitters and receivers)**
- **Ionosonde**
- **Tilt-sonde**
- **GPS receivers (TEC and scintillation)**
- **Etc**

➤ **Theory and Software:**

- **Ionospheric/space-weather expertise**
- **TID and gravity wave expertise**
- **Theoretical understanding**
- **Data analysis capabilities**
- **Algorithm development**
- **Etc**



Contact Information

❖ Science

❖ Technology

❖ Applications

Bringing It All Together



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